



WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2005HI114B

Title: Diffusive tortuosity of reactive porous media: Application to colloidal and bio-fouling during membrane filtration

Project Type: Research

Focus Categories: Solute Transport, Water Quality, Models

Keywords: Diffusive tortuosity, porous media, membrane fouling, biofilm

Start Date: 03/01/2005

End Date: 02/28/2006

Federal Funds: \$11,717

Non-Federal Matching Funds: \$23,187

Congressional District:

Principal Investigator:

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Abstract

Membrane fouling in reverse osmosis and nanofiltration will be fundamentally investigated in this research project when rejected colloids and/or microorganisms provide precipitous permeate flux decline by hindering diffusion of salt ions from the membrane surface to bulk phase. Pearsonian random walk simulation will be employed to mimic diffusive motions of solute ions within the colloidal cake layer or deformable biofilm. The hindered diffusion of solutes will be classified into two categories: physical obstruction and chemical reaction. The former is due to presence of the cake layer of tortuous void paths, and the latter is due to chemical sorption/ desorption process of solute ions on particle surfaces. Both the hindrance significantly reduces solute diffusion, enhancing concentration polarization, but only free solutes within the void spaces can contribute the osmotic pressure that causes decrease in the effective pressure of membrane filtration. In this study, therefore, physical and chemical hindrance of solute diffusion will be carefully scrutinized and will be used to develop a new filtration theory.